

1987 RESEARCH PAPERS Forest Pest Management in Michigan



JACK PINE BUDWORM SURVEY SUMMARY: REGION I, MICHIGAN'S UPPER PENINSULA

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From June through August, 1987, we conducted the second successive survey of jack pine budworm activity in the Upper Peninsula. A comparison of data from the two surveys is made to look at the utility of pheromone trapping for predicting budworm population numbers. We are also studying the relationship of population numbers to resulting defoliation, growth loss, and tree mortality of jack pine. The project goal is to produce better prediction tools for managing jack pine and the jack pine budworm.

BACKGROUND

Knowledge of budworm population trends and expected damage is important in our efforts to reduce future economic losses from jack pine budworm outbreaks. Surveys of budworm defoliation from the ground and from the air are useful in comparing damage levels between stands, evaluating the effectiveness of control measures, and providing a rough idea of the expanse of an infestation.

Budworm populations are monitored in the pre-adult stages to detect building populations and predict damage levels.

These surveys are costly and time consuming, and often impractical when budworm populations are very low. Monitoring the adult male population with pheromone traps may offer a desirable alternative. Pheromone trapping allows managers to monitor large areas of jack pine more efficiently, especially at low population levels. Theoretically, an effective pheromone trapping system can be used to monitor long-term fluctuations in population densities for long-range prediction of budworm outbreaks. Lead time would be provided for special operations such as establishing pre-salvage schedules and preparing marketing-utilization efforts.

METHODS

Sixteen sites were monitored with a synthetic jack pine budworm pheromone. Sites were selected from an existing network of permanent jack pine budworm impact plots.

Impact plots contained 90 trees -- 30 trees in three plots labeled "A", "B", and "C". The center of impact plot "B" in each area was used as a trap tree in the trapping plot. A trapping plot consisted of three traps in a triangular configuration. Each leg of the triangle was approximately 40 meters (two chains) long and all traps were at least 40 meters from any roads or major openings in the forest.



Traps were hung in marked trap trees 2 to 3 meters (6 to 9 feet) above the ground and, where possible, 0.7 to 1.0 meters (2 to 3 feet) away from the tree trunk to permit free air flow and not obstruct trap openings.

Forty-eight traps were placed in the field during the first week of July and retrieved during the third week of August. Trap catches were small enough to be counted in the field. Number of male moths captured was recorded by plot.

An aerial survey of all the plots was flown in mid July. Aerial photos were taken of the plot areas and average defoliation within one mile of each of the plots was noted as follows:

20%	=	light
21 to 50%	=	moderate
>50%	=	heavy

A ground survey of defoliation was made in late July. Ten trees in each of the impact plots were carefully examined with binoculars and with the unaided eye. Individual trees were ranked according to the percentage of new foliage eaten as follows:

none	=	no observable defoliation
<20%	=	light
21 to 50%	=	moderate
>50%	=	heavy

In addition to the defoliation (damage) surveys, a number of pre-adult surveys was taken in each of the trapping plots. The first was an early larval survey conducted in early June. Thirty vegetative buds (shoots) and staminate cones (flowers) were examined from five trees in each plot. The number of tips with at least one larva was recorded. Wherever possible, 15 shoots and 15 flower clusters were examined.

Where staminate cones were not abundant, more shoots than flower clusters were sampled. A survey of flower abundance was also conducted at this time. The percent of branch tips with flowers was noted:

<30% w/ flowers	=	light
31 to 60% w/flowers	=	moderate
>60% w/ flowers	=	heavy

A late larval (5th and 6th instars) survey was conducted in late June. Two 15-inch branch samples were taken from the mid-crown of each of three trees in each of the three impact plots. Samples were collected in a basket attached to a pole pruner. The larvae were counted and a total for each tree was recorded. An average number of larvae per 15-inch branch was then determined.

Pupal surveys were conducted in each of the plots from mid to late July. The time to collect pupae or pupal cases from the lower branches and understory trees was recorded. If five pupae were found within five minutes of the recorded starting time, sampling stopped. If five pupae were found within five minutes, examination continued until 25 pupae were found. Collected pupae were stored to determine the emergence rate of adults and the prevalence of budworm parasites and disease pathogens.

Upon completion of the population surveys, tree condition was assessed within each plot. All trees were examined for changes in growth, defoliation ranking, and percent live crown.

RESULTS

Table 10 displays the results of the defoliation and population surveys from 1987. The average number of early instar larvae (#/15 shoots and 15 flowers), the average number of late instar larvae (#/15-inch branch), the average number of



pupae (# collected/5 minute interval), and the average number of moths captured per trap for each permanent sampling plot can be reviewed in both Table 10 and Figures 1 to 3. Staminate flower abundance is reported in Table 10.

Defoliation and population survey results for 1987 and 1986 are displayed graphically in Figures 1 to 4 and Figures 5 and 6, respectively. These figures also include adult trap catches for each plot from 1985 to 1987. Defoliation data in the figures are from ground surveys used to assess percent needle loss as light defoliation = 10%; moderate = 25%; and heavy = 50%. Variation within defoliation categories is not shown.

Tree growth and condition in the impact plots did not change noticeably from 1986 to 1987.

DISCUSSION

The collapse of jack pine budworm populations throughout the U.P. in 1986 has complicated the evaluation of the survey results. A seemingly significant 1986 trap catch in Plot 5 did not result in the expected defoliation in 1987 (Figure 2). Conversely, relatively small to moderate trap catches in Plot 1 for all three years resulted in the heaviest defoliation recorded for all of the Upper Peninsula in 1986 and 1987 (Figures 1 and 5). There appears to be little correlation between average pheromone trap catches and either pre-adult population survey data or defoliation estimates.

One could speculate that correlating adult trap catches with jack pine defoliation on a plot by plot basis is a very tricky business. Upon trapping a moth, one does not know if it is from a distant population or of local origin. If of local origin, is the

Table 10. Jack pine budworm defoliation and population survey results from 1987. ¹

Plot	Defoliation		Early Instar	Late Instar	Pupal	Adult	Staminate Flowers
	Aerial	Ground					
1	Moderate	Heavy	13.0	7.4	35.0	13.0	Moderate
2	Moderate	Moderate	12.0	6.9	46.0	50.0	Light
3	Light	Light	0.0	0.0	0.0	2.0	Light
4	Light	Light	1.3	0.2	0.0	1.0	Light
5	Light	Light	0.7	0.0	0.0	0.7	Moderate
6	Light	Light	0.7	0.3	1.0	8.0	Heavy
7	Light	Light	0.3	0.3	1.0	6.0	Moderate
8	Light	Light	1.0	0.2	1.0	13.0	Moderate
9	Light	Light	0.0	0.0	0.0	5.0	Moderate
10	Light	Light	0.4	0.0	0.0	1.0	Light
11	Light	Light	0.2	0.0	1.0	1.7	Light
12	Light	Light	0.0	0.0	1.0	2.0	Moderate
13	Light	Light	0.0	0.0	1.0	2.7	Moderate
14	Light	Light	0.1	0.2	0.0	0.0	Moderate
15	Light	Light	0.1	0.1	0.0	1.3	Moderate
16	Light	Light	1.9	1.1	0.0	2.0	Moderate

¹ See text for descriptions of units and collection techniques.



moth population that it represents on its way to another jack pine area outside the plot sampling boundary? Will a significant number migrate to significantly reduce the population density within the plot sampling boundary? Are migrating moths subject to trapping? If so, trapping results are certainly predictive only on a larger geographic scale.

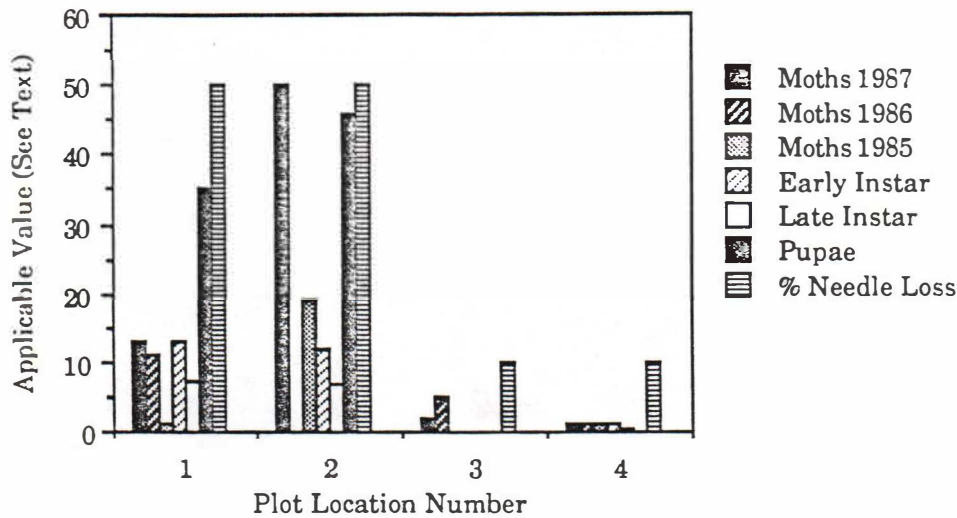


Figure 1. 1987 jack pine budworm immature stages and ground defoliation survey results with 1985 to 1987 adult pheromone trap catches for plots 1 to 4.

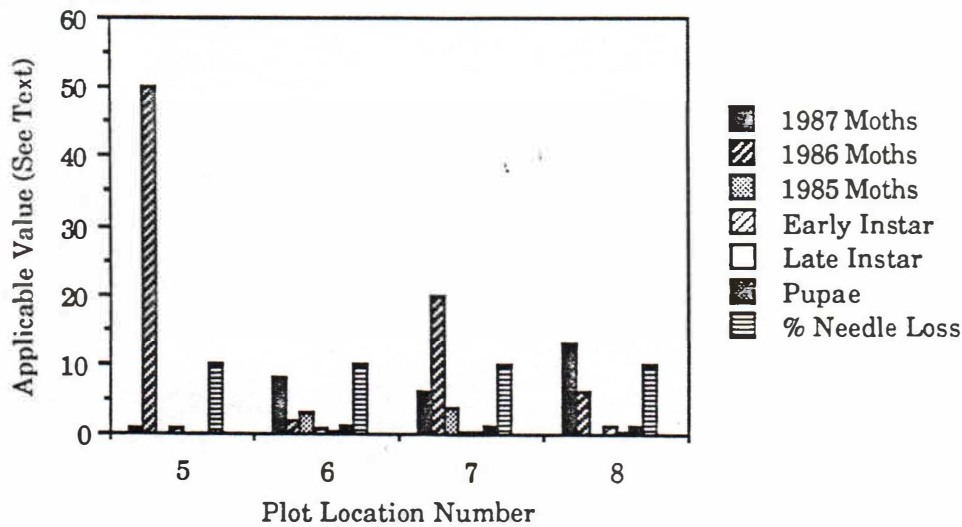
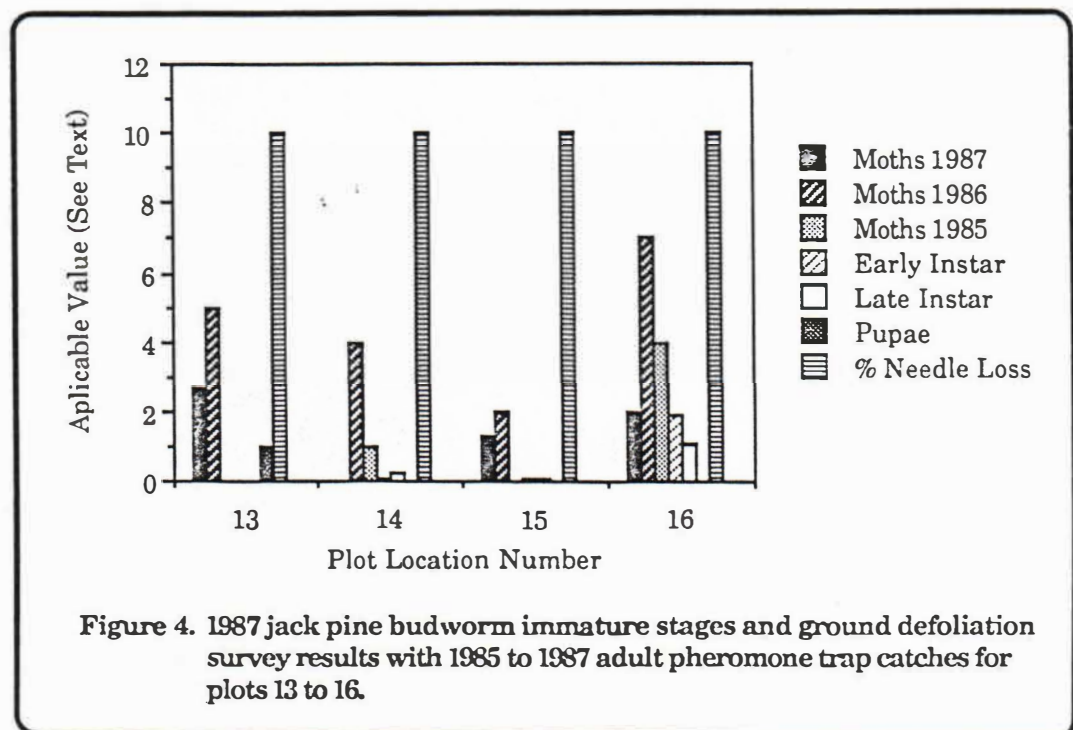
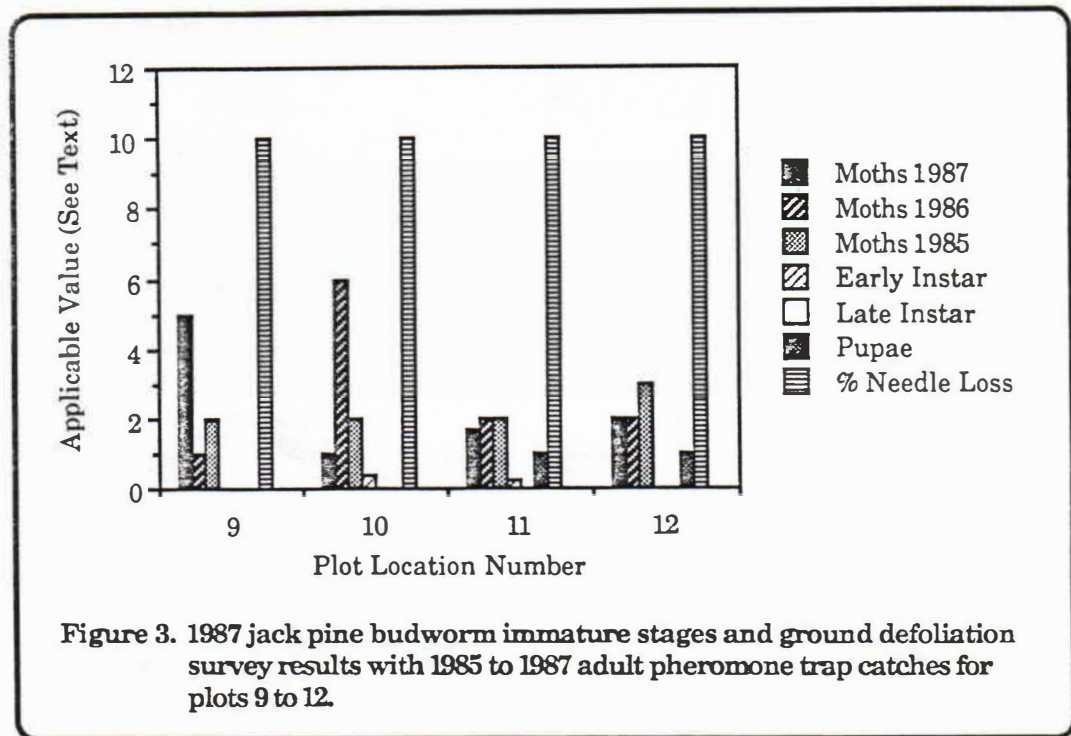


Figure 2. 1987 jack pine budworm immature stages and ground defoliation survey results with 1985 to 1987 adult pheromone trap catches for plots 5 to 8.



Jack pine flower abundance is best used to interpret the results of early larval surveys. Larval survival and vigor are positively correlated with flower abundance. We also reported last year that heavy flowering kept larvae in the cones and away from needle feeding. This was only a temporary reprieve. These plots were heavily defoliated this year. Flower abundance does not seem to affect budworm stand selection.



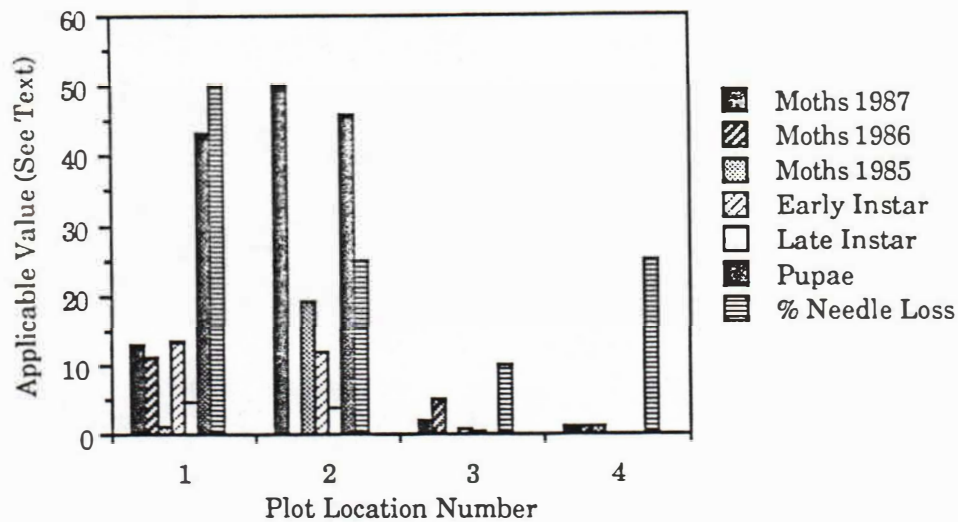


Figure 5. 1986 jack pine budworm immature stages and ground defoliation survey results with 1985 to 1987 adult pheromone trap catches for plots 1 to 4.

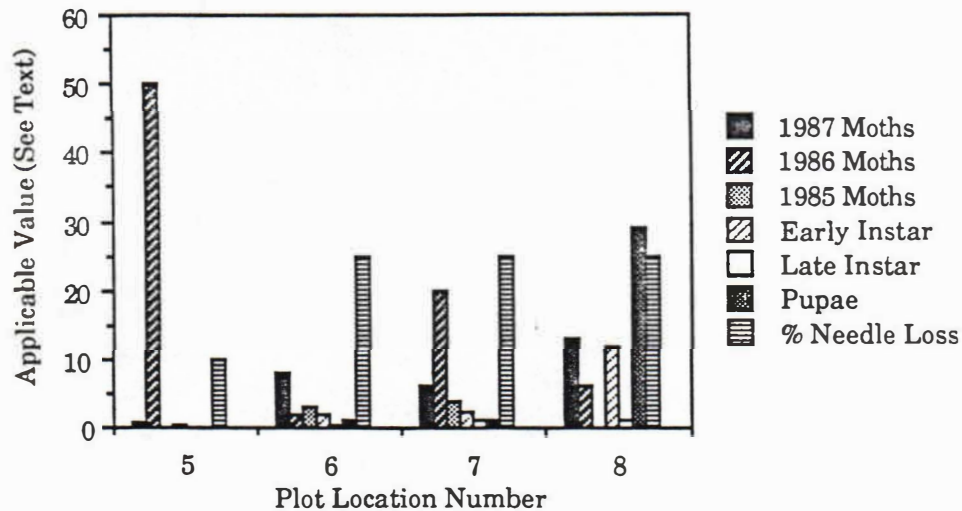


Figure 6. 1986 jack pine budworm immature stages and ground defoliation survey results with 1985 to 1987 adult pheromone trap catches for plots 5 to 8.

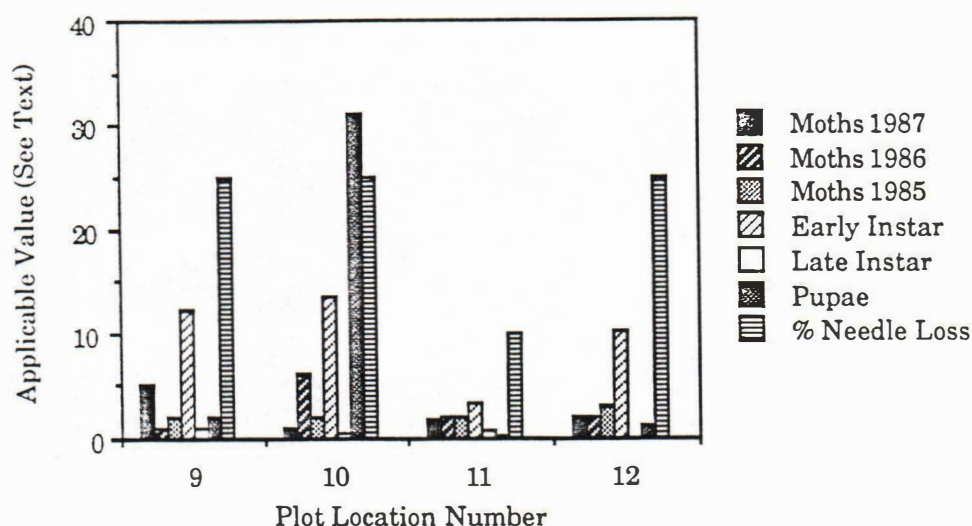


Figure 7. 1986 jack pine budworm immature stages and ground defoliation survey results with 1985 to 1987 adult pheromone trap catches for plots 9 to 12.

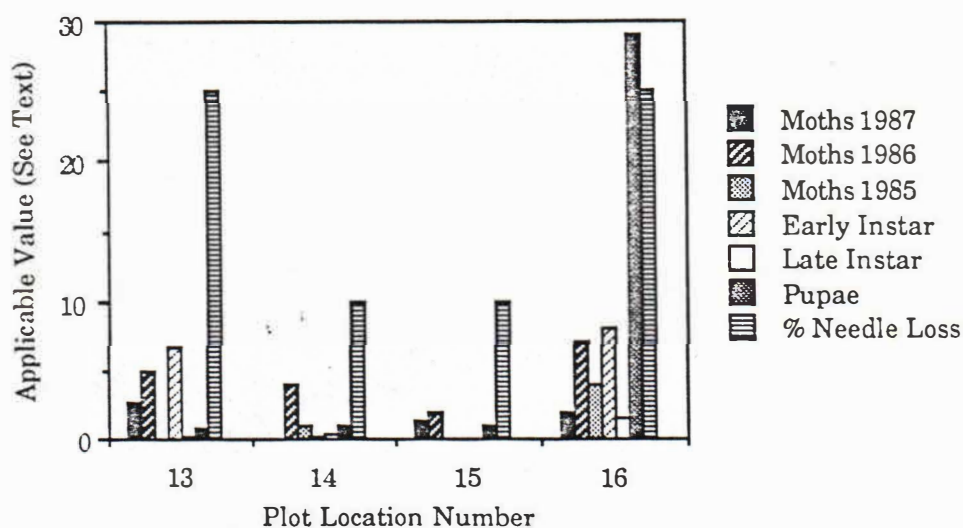


Figure 8. 1986 jack pine budworm immature stages and ground defoliation survey results with 1985 to 1987 adult pheromone trap catches for plots 13 to 16.